Paper 7, TDC Part-3
Chapter– 4, Combinational Logic Design
Lecture - 19

By:

Mayank Mausam

Assistant Professor (Guest Faculty)

Department of Electronics

L.S. College, BRA Bihar University,

Muzaffarpur, Bihar

Combinational Logic Design

EX-OR and EX-NOR Simplification of K-Maps

In many situations in logic design, simplification of logic expression is possible in terms of EX-OR and EX-NOR operations. These functions are widely used in digital design and therefore are available in IC form.

Here we see recognising K-Map pattern indicating EX-OR and EX-NOR functio
In the case of EX-OR and EX-NOR simplication we have to look for

REDMI NOTE 8 PRO

Combinational Logic Design

1.) Diagonal Adjacencies
2.) Offset Adjacencies

Terms corresponding to each group of diagonal / Offset adjacencies involve EX-OR / EX-NOR operation.

Let us see through K-Map.

(a) 2-Variable K-Map :->

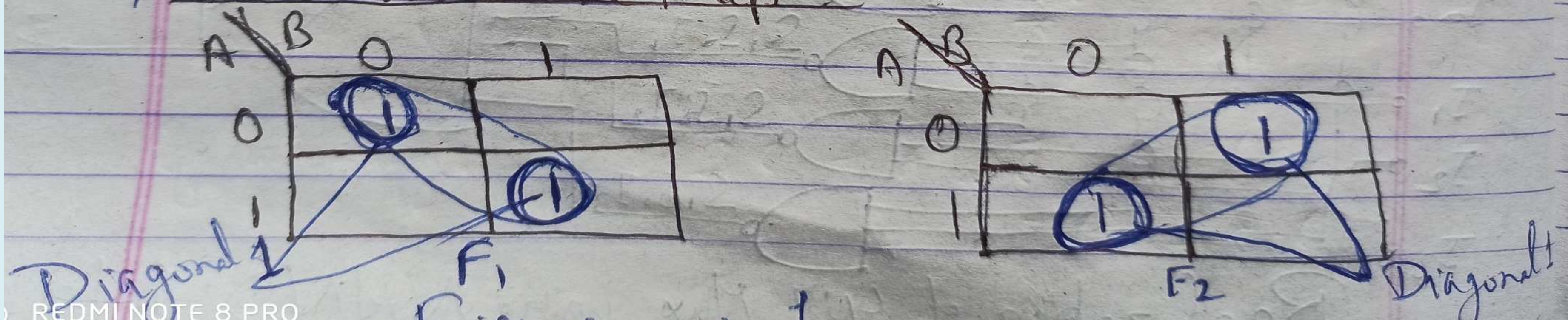


Figure → 1

Combinational Logic Design

In a K-Map two 1's / 0's are said to be diagonal adjacencies if their grouping is not possible and the ~~term involve in~~ corresponding term will involve EX-OR/ EX-NOR logic.

Similarly two 1's/0's are said to be in offset adjacencies if their grouping is possible and they are in same row/column. Term corresponding to offset adjacencies will involve EX-OR/EX-NOR logic.

In figure 1 of 2 variable K-Map for F_1, the grouping of 1's is not possible these 1's are in diagonal adjacencies.

Combinational Logic Design

$F_1 = \bar{A}\bar{B} + AB = A \odot B$

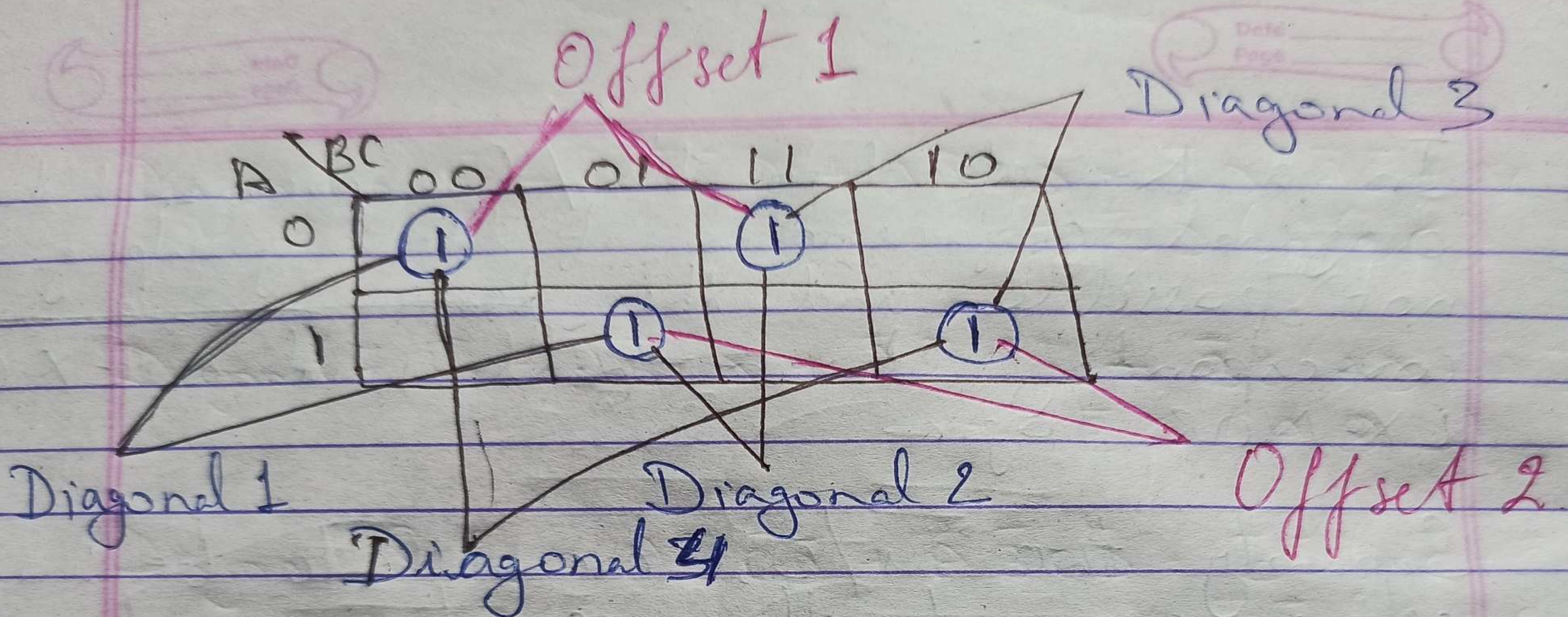
Illy for F_2

$F_2 = \bar{A}B + A\bar{B} = A \oplus B$

In a 2-variable K-map no ~~x~~ 1's will be in offset adjacencies, i.e. no offset adjacencies are possible.

Now let us look 3-variable K-Map for diagonal adjacencies & offset adjacencies.

Combinational Logic Design



K-map (for 3 variable) illustrating Diagonal and Offset Adjacencies

Diagonal 1, $F_1 = \bar{A}\bar{B}\bar{C} + A\bar{B}C$

$= \bar{B}(\bar{A}\bar{C} + AC)$

$= \bar{B}(A \odot C)$

Combinational Logic Design

Diagonal 2, $F_2 = A\bar{B}C + \bar{A}BC = C(A\bar{B} + \bar{A}B)$

$= C(A \oplus B)$

Diagonal 3, $f_3 = \bar{A}BC + AB\bar{C} = B(\bar{A}C + A\bar{C})$

$= B(A \oplus C)$

Diagonal 4, $F_4 = \bar{A}\bar{B}\bar{C} + AB\bar{C} = (\bar{A}\bar{B} + AB)\bar{C}$

$= (A \odot B)\bar{C}$

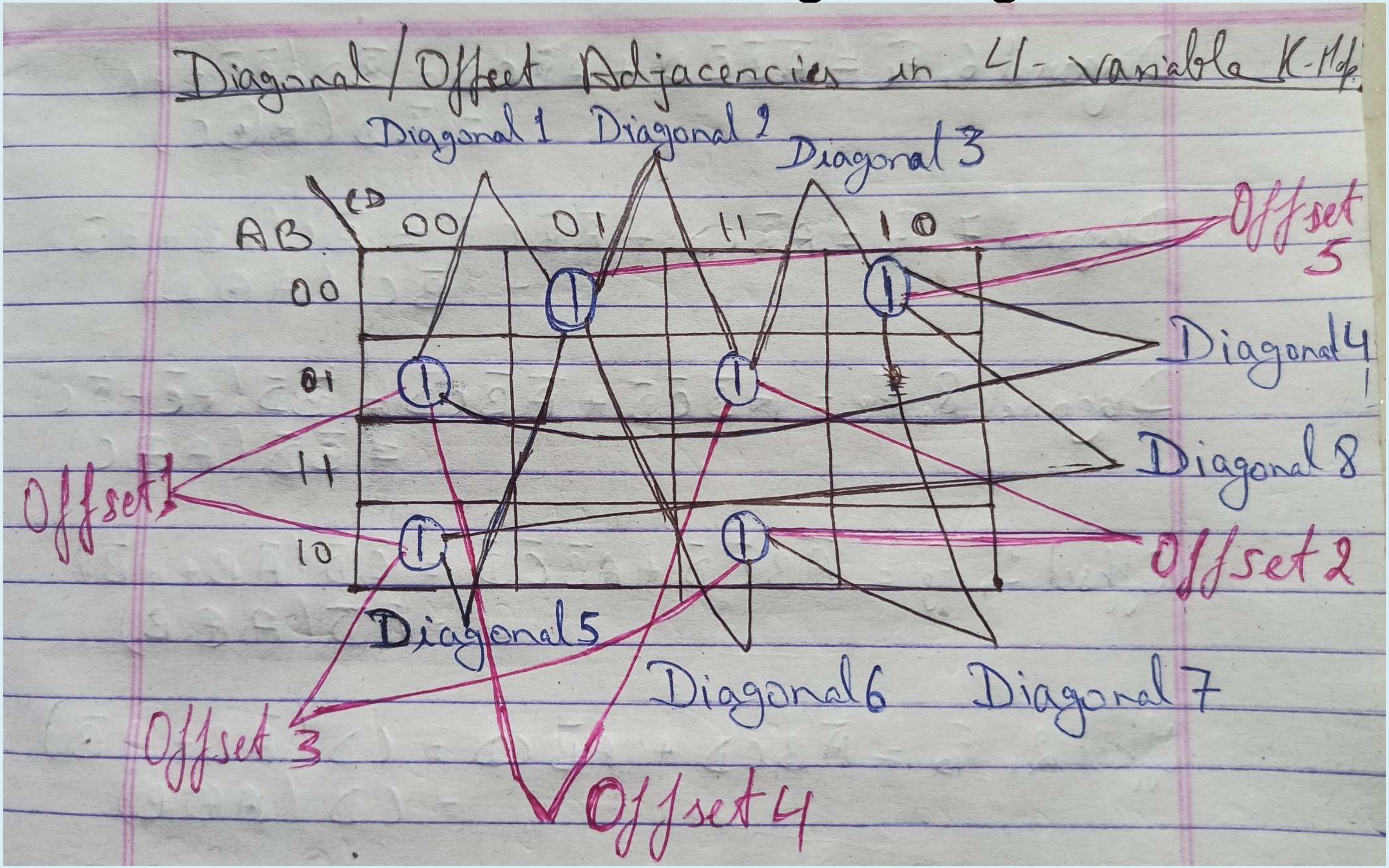
Offset 1, $F_5 = \bar{A}\bar{B}\bar{C} + \bar{A}BC = \bar{A}(\bar{B}\bar{C} + BC)$

$= \bar{A}(B \odot C)$

Offset 2, $F_6 = A\bar{B}C + AB\bar{C} = A(\bar{B}C + B\bar{C})$

$= A(B \oplus C)$

Combinational Logic Design



Combinational Logic Design

Diagonal 1, $f_1 = \bar{A}\bar{B}\bar{C}D + \bar{A}B\bar{C}\bar{D} = \bar{A}\bar{C}(\bar{B}D + B\bar{D})$

$= \bar{A}\bar{C}(B \oplus D)$

Diagonal 2, $F_2 = \bar{A}\bar{B}\bar{C}D + \bar{A}BCD = \bar{A}D(\bar{B}\bar{C} + BC)$

$= \bar{A}D(B \odot C)$

Diagonal 3, $F_3 = \bar{A}BCD + \bar{A}\bar{B}C\bar{D} = \bar{A}C(BD + \bar{B}\bar{D})$

$= \bar{A}C(B \odot D)$

Diagonal 4, $F_4 = \bar{A}B\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} = \bar{A}\bar{D}(B\bar{C} + \bar{B}C)$

$= \bar{A}\bar{D}(B \oplus C)$

Diagonal 5, $F_5 = A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D = \bar{B}\bar{C}(A\bar{D} + \bar{A}D)$

$= \bar{B}\bar{C}(A \oplus D)$

Combinational Logic Design

Diagonal 6, $F_6 = \bar{A}\bar{B}\bar{C}D + A\bar{B}CD = \bar{B}D(\bar{A}\bar{C} + AC)$

$= \bar{B}D(A \odot C)$

Diagonal 7, $F_7 = A\bar{B}CD + \bar{A}\bar{B}C\bar{D} = \bar{B}C(AD + \bar{A}\bar{D})$

$= \bar{B}C(A \odot D)$

Diagonal 8, $F_8 = A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D} = \bar{B}\bar{D}(A\bar{C} + \bar{A}C)$

$= \bar{B}\bar{D}(A \oplus C)$

Offset 1, $F_9 = \bar{A}B\bar{C}\bar{D} + A\bar{B}\bar{C}\bar{D} = \bar{C}\bar{D}(\bar{A}B + A\bar{B})$

$= \bar{C}\bar{D}(A \oplus B)$

Offset 2, $F_{10} = \bar{A}BCD + A\bar{B}CD = CD(\bar{A}B + A\bar{B})$

$= CD(A \oplus B)$

Combinational Logic Design

Offset 3, $F_{11} = A\bar{B}\bar{C}\bar{D} + A\bar{B}CD = A\bar{B}(\bar{C}\bar{D} + CD)$
$= A\bar{B}(C \odot D)$

Offset 4, $F_{12} = \bar{A}B\bar{C}\bar{D} + \bar{A}BCD = \bar{A}B(\bar{C}\bar{D} + CD)$
$= \bar{A}B(C \odot D)$

Offset 5, $F_{13} = \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} = \bar{A}\bar{B}(\bar{C}D + C\bar{D})$
$= \bar{A}\bar{B}(C \oplus D)$

From this we see the way to identify diagonal / offset adjacencies and the method of obtaining the term corresponding to each grouping.

Combinational Logic Design

Refer book- Modern Digital Electronics by RP Jain.

<u>Thank You</u>